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APPLICATION NUMBER: ***60/482,460***
FILING DATE: ***June 26, 2003***
RELATED PCT APPLICATION NUMBER: ***PCT/US04/20767***

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a r qu st f r filing a PROVISIONAL APPLICATION FOR PATENT und r 37 CFR 1.53(c).

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Patrick K.	Sullivan	Honolulu, Hawaii

☐ *Additional inventors are being named on the ___ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

Radiation Stress Non-Invasive Blood Pressure Method

CORRESPONDENCE ADDRESS

Direct all correspondence to:

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ENCLOSED APPLICATION PARTS *(check all that apply)*

[X] Specification *Number of Pages* 8
[X] Drawing(s) *Number of Sheets* 3
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number
☐ Other (specify)

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

[X] Applicant claims small entity status. See 37 CFR 1.27.
[X] A check or money order is enclosed to cover the filing fees
☐ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
[X] No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: __________

Respectfully submitted,

SIGNATURE JCWray

Date 06/26/03

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REGISTRATION NO. *(if appropriate)* 22,6933

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FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

[X] Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 80.00

Complete if Known	
Application Number	
Filing Date	06/26/2003
First Named Inventor	Patrick K. Sullivan
Examiner Name	
Art Unit	
Attorney Docket No.	OCEANIT

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	750	2001	375	Utility filing fee	
1002	330	2002	165	Design filing fee	
1003	520	2003	260	Plant filing fee	
1004	750	2004	375	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	80

SUBTOTAL (1) ($) 80.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X		=	
Independent Claims		- 3** =		X		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	84	2201	42	Independent claims in excess of 3
1203	280	2203	140	Multiple dependent claim, if not paid
1204	84	2204	42	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

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FEE CALCULATION (continued)

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1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	410	2252	205	Extension for reply within second month	
1253	930	2253	465	Extension for reply within third month	
1254	1,450	2254	725	Extension for reply within fourth month	
1255	1,970	2255	985	Extension for reply within fifth month	
1401	320	2401	160	Notice of Appeal	
1402	320	2402	160	Filing a brief in support of an appeal	
1403	280	2403	140	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,300	2453	650	Petition to revive - unintentional	
1501	1,300	2501	650	Utility issue fee (or reissue)	
1502	470	2502	235	Design issue fee	
1503	630	2503	315	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	750	2809	375	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	750	2810	375	For each additional invention to be examined (37 CFR 1.129(b))	
1801	750	2801	375	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY (Complete (*if applicable*))

Name (Print/Type)	James C. Wray	Registration No. (Attorney/Agent)	22,693	Telephone	(703) 442-4800
Signature				Date	06/26/2003

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RADIATION STRESS NON-INVASIVE BLOOD PRESSURE METHOD

BACKGROUND OF THE INVENTION

Current methods for measurement of blood pressure and other vital signs are inefficient. Many measurements of patient vital signs are invasive procedures that are uncomfortable or inconvenient for the patient. Typically, the measurement of blood pressure requires the use of a cuff around the arm of a patient and is a non-continuous "spot-check" that does not reflect the true state of patient physiology.

Needs exist for improved methods of continuous non-invasive blood pressure measurements.

SUMMARY OF THE INVENTION

The present invention is a system that provides non-invasive, real-time, continuous collection and processing of signals from a patient to determine the current condition of the patient. The present invention relates preferably to the measurement of blood pressure. This measurement includes the average, mean, systolic and diastolic arterial blood pressure. However, the present invention is not limited to the measurement of blood pressure; other vital signs can be measured and processed as well. The present method also provides for continuous, non-invasive monitoring of hypertension and other related medical conditions.

The present invention uses acoustic, electromechanical or other related physiological signals collected from a patient. To operate the monitoring device, the patient engages a discritized, discrete, separated sensors in one or more discrete sensing arrays installed in a bed, chair or any other equipment that the patient will use. The patient lies down on, sits on, stands on, or otherwise engages the discritized sensing array, and signals are monitored over a range of

frequencies or at a specific frequency. Data is collected as a time series or another similar method. Data is transferred to a computing device in the form of a voltage signal via wire, fiber optics or wireless technology.

The energy spectra of each array point are determined and then are used to determine the variance of each array. Computational analysis of the data collected is used to determine energy momentum flux of blood flowing through the patient. Non-time series methods are used to determine energy at various array points or at a combination of array points. Momentum flux is determined from the data collected by the discritized separate sensors in each array. Blood pressure is related to the momentum flux through a mathematical algorithm. A computing device performs the computation of blood pressure.

These and further and other objects and features of the invention are apparent in the disclosure, which includes the above and ongoing written specification, with the claims and the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram of the monitoring system with a discritized array.

Figure 2 is a diagram of energy spectra collected from location 1 to location n.

Figure 3 is a schematic representation of a person lying on an array of sensors.

Figures 4 and 5 are schematic representations of portions of sheets with sensor arrays.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a system that provides real-time, continuous collection and processing of signals from a patient to determine the condition of the patient. The present

invention relates preferably to the measurement of blood pressure. The measurements include the average, mean, systolic and diastolic arterial blood pressure. The present invention is not limited to the measurement of blood pressure; other vital functions, for example, heart rate and pulses and electrical signals, can be measured and processed as well. The present method provides for continuous, non-invasive monitoring of hypertension and other related medical conditions.

Figure 1 shows a diagram of a monitoring system 1 and a discritized array 3 of separate sensors 9. The present invention uses acoustic, electromechanical or other related physiological signals collected from a patient 5 in contact with the discritized sensors in the sensing array 3. The discritized sensing array 3 is a relatively flat device 7 with individual sensing arrays 9 dispersed throughout the surface of the discritized sensing array 3. The patient 5 lies down on, stands on, or otherwise engages the discritized sensing array 3, and signals are monitored over a range of frequencies or at a specific frequency, as shown in Figure 3. Data is collected as a time series or another similar method. Data is collected from individual sensing arrays 9, from grid locations 1 to n, via acoustic, electromechanical or other physiological signals.

The discritized sensing array 3 can have sensors arranged in various regular or irregular configurations. Figure 4 and Figure 5 show different arrangements of individual sensors 9 on a portion of the large discritized sensing array.

The discritized sensing array 3 provides time series data that is analyzed to produce energy spectra at locations 1 to n, as shown in Figure 2. The data is used to determine the variance of the time series signals. Computational analysis of data collected is used to determine momentum flux of energy through the patient.

Blood pressure is related to the momentum flux through a mathematical model. The

following relationship relates the incoming data to blood pressure:

Pa = K*(E1 – En) = Average pressure due to excess flow of momentum

Pa = Average blood pressure

K = Constant

E1 = Summation of energy spectra (area under the curve – variance of time series) at location 1 x Pulse wave velocity

En = Summation of energy spectra (area under the curve – variance of time series) at location n x Pulse wave velocity

A computing device performs the computation of blood pressure. The results of computation are output to the user.

The radiation stress, non-invasive blood pressure device of the present invention uses time series analysis and computational methods to process acoustic, electromechanical or other physiological signals from the patient. An energy spectrum is created by the sensing arrays to calculate the variance. The variance is the area under the energy spectra curve. Non-time series methods are used to determine energy at various array points.

While the invention has been described with reference to specific embodiments, modifications and variations of the invention may be constructed without departing from the scope of the invention, which is described in the following claims.

Claims:

1. A radiation stress, non-invasive vital sign monitoring method comprising:

providing a discritized array,

collecting acoustic, electromechanical or other physiological signals with the discritized array,

transmitting signals to a receiving and computing device,

producing time series data from various locations on the array,

calculating energy spectrum,

determining variance of each array,

calculating a value for a vital sign of a patient.

2. The method of claim 1, wherein the collecting acoustic, electromechanical or other physiological signals further comprises contacting of the discritized array by the patient.

3. The method of claim 2, further comprising lying on, standing on, or otherwise engaging of the discritized array by the patient.

4. The method of claim 1, further comprising collecting data over a range of frequencies or over a single frequency.

5. The method of claim 1, wherein the collecting acoustic, electromechanical or other physiological signals further comprises collecting data in a time domain or frequency domain.

6. The method of claim 1, further comprising calculating a value for a vital sign with non-time series methods for determining energy at various array points or a combination of array points.

7. The method of claim 1, wherein the transmitting of signals comprises transmitting voltage signals via wire, fiber optics or wirelessly.

8. The method of claim 1, further comprising providing continuous, real-time monitoring of a patient's vital signs.

9. The method of claim 1, further comprising calculating the momentum flux from data gathered from the signal arrays.

10. The method of claim 9, further comprising calculating a patient's vital signs from the momentum flux.

11. The method of claim 1, wherein the vital sign is blood pressure.

12. A radiation stress, non-invasive vital sign monitoring device comprising:

a discritized array for measuring acoustic, electromechanical, or other physiological signals from a patient,

a surface of the discritized array for contacting a patient,

a transmission system for data collected by the discritized array,

a computing device for receiving data from the discritized array and calculating values of vital signs.

13. The monitoring device of claim 12, wherein the discritized array collects data over a range of frequencies or in a single frequency.

14. The monitoring device of claim 12, wherein the data is collected in a time domain or frequency domain.

15. The monitoring device of claim 12, wherein a patient lies on, stands on or otherwise engages the discritized array.

16. The monitoring device of claim 12, wherein the transmission system transmits a voltage signal via wire, fiber optics or wirelessly.

17. The monitoring device of claim 12, wherein a non-time series is used for determining

energy at various array points or combinations of array points.

18. The monitoring device of claim 12, wherein the computing device calculates momentum flux from the collected data.

19. The monitoring device of claim 18, wherein the computing device converts the momentum flux to a value for a vital sign through a mathematical relationship.

20. The method of claim 12, wherein continuous, real-time monitoring of a patient's vital signs is provided by the discritized sensor array.

ABSTRACT

The invention determines the energy dispersion via acoustic, electromechanical or other related physiological signals collected from a patient that lies down or otherwise engages a discritized sensing array. Signals are monitored over a range of frequencies and collected in the time domain or frequency domain. A computing machine determines the energy from the signal measured over various elements of the array and calculates the momentum flux. Blood pressure is determined directly from the momentum flux calculation.

Figure 1

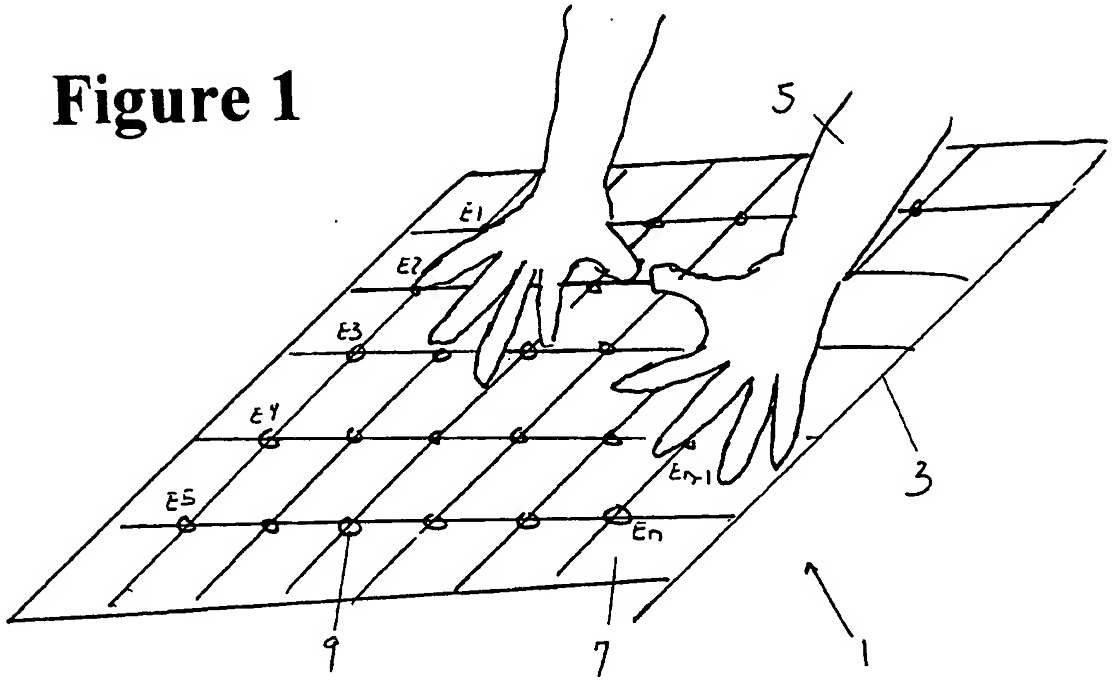
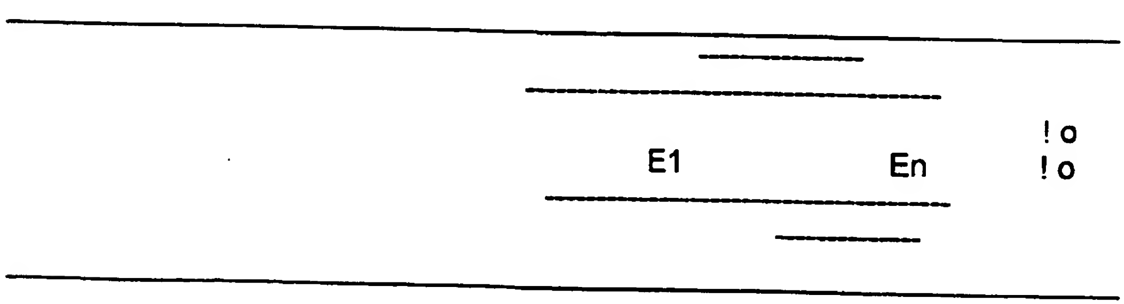


Figure 2



E1 = energy spectra collected from location 1
En = energy spectra collected from location n

Figure 3

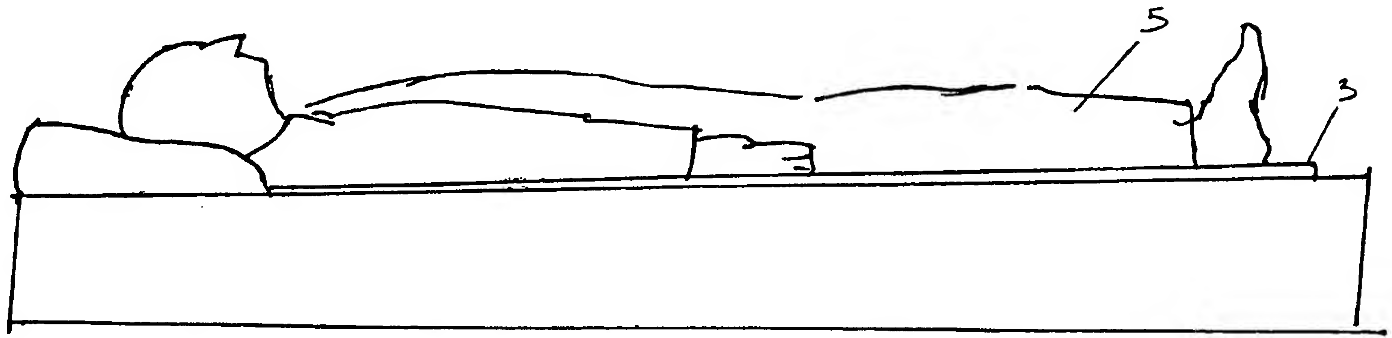


Figure 4

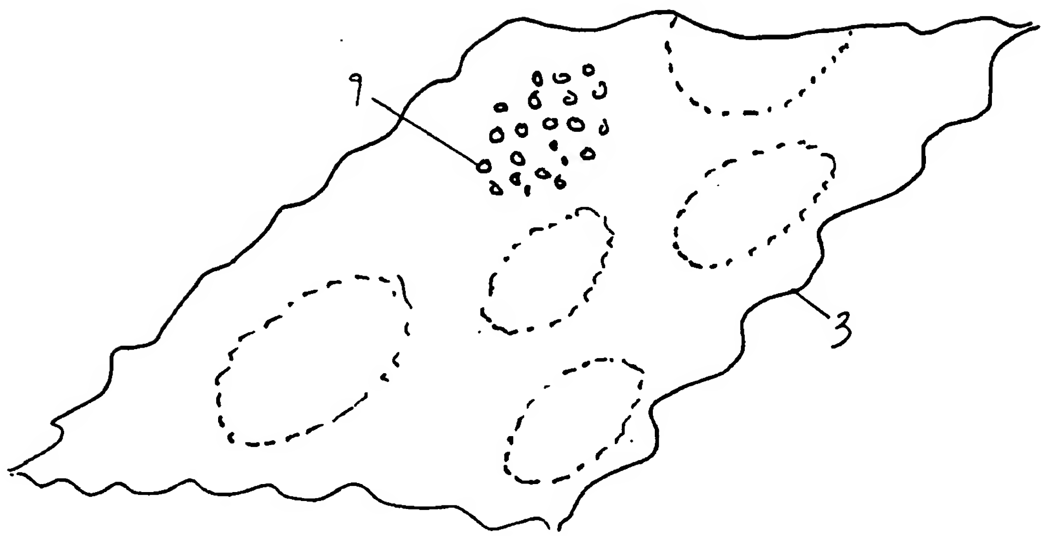


Figure 5